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LONGER TERM CONSEQUENCES OF THE SHORT TAKE-OFF AND LANDING  
(STOL) AIRCRAFT SYSTEM

A TECHNOLOGY ASSESSMENT PROJECT

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Todd R. La Porte, Principal Investigator  
(Research Supported through NASA Grant NGR 05-003-0471)

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## INTRODUCTION

During the initial period of this grant, Summer, 1971, the STOL assessment group developed the basis for a range of studies which we concluded were of major importance in the assessment of the STOL aircraft and the various means of employing it. These study outlines and a partial development of the rationale underlying them were presented in our Progress Report, *A PERSPECTIVE IN THE ASSESSMENT OF LARGE-SCALE TECHNOLOGY: THE CASE OF THE STOL AIRCRAFT TRANSPORT SYSTEM* (November, 1971). In that report we attempted to determine the significance of these study projects for the social assessment of technologies in general and for the STOL aircraft system in particular. Our current work is intended to demonstrate the degrees to which these studies are tractable and, in so doing, to explore and evaluate possible results. To this end the first six months of the grant period have been spent in gathering ourselves for our second summer of intensive work.

During the academic year, our work has progressed relatively slowly -- at about one-quarter to one-third pace. We have been engaged in formal academic study somewhat removed from straightforward STOL work; a good deal of this, however, has been indirectly connected with the STOL Assessment Project.\* Activities directly related to this project are reported below; they include searches of the social sciences literature for empirically based studies, primarily methodological ones, and an exploration of problems in regulating technology. The most finished aspect of our work in this period is the development of a questionnaire to be used in the study of the "Public Attitudes toward Technology" survey phase of our assessment project. Completed by the Field Research Corporation as a reliable data gathering instrument, poll data from FRC will be available to us for analysis in early August.

This review of the activities for the latest period of the grant includes a brief note on our progress with theoretical issues and *conceptual problems* intrinsic to the assessment task, reports on *methodological explorations*, a formulation of a tentative approach to the study of the effect of *transport mobility* on *social change*, and a synopsis of the finished questionnaire for the *survey of attitudes toward technology*; the review concludes with a brief paper on the problems of *technology and regulation*. A preliminary *Selected Bibliography* arranged according to these subject categories is also included.

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(\*Note: Two members of the STOL group (Todd La Porte and Kai N. Lee), neither directly supported during this period of the grant, engaged in planning a jointly taught course -- *Political Science 188: Technology as a Political Problem* -- which investigates many areas relevant to the STOL Assessment Project. The study on *Conceptual Problems in Technology Assessment* referred to on the following page in part has grown out of their teaching experiences in this course.)

## NOTES ON CONCEPTUAL PROBLEMS IN TECHNOLOGY ASSESSMENT

Todd La Porte

(Central to our more detailed studies, the conceptualizing of technology occupied a major portion of our time last summer. During this period it has been given less formal attention because our main activities have been in evaluating the literature of technology assessment in methodological terms. Preliminary results of these activities are reported in the next section of this review. However, a draft paper on the crucial subject of conceptual problems in technology assessment has been produced by Todd La Porte and Kai Lee. It is being revised for inclusion in our final STOL Assessment Project report.)

Our work here elaborates the outline presented in *Chapter One* of our November 30, 1971, *PROGRESS REPORT* to Ames Research Center. Large technical systems are understood to include *both* the theoretical and practical knowledge needed for realizing a technical capacity *and* the numbers of people and organizations embodying that knowledge. In a sense, these collections of people and groups are technology come alive in personal action and group achievement. Further, we include in our concept of technological systems those people and institutions associated with the distribution and regulation of a technology. Viewing large technical systems in this way enables us to think through the full range of social and organizational activities needed to make technical capacity available to many people and to regulate its use and development. It has also given us a basis for identifying the individuals and organizations who are affected directly and indirectly by "technological change," that is, by changes in the behavior of people and organizations engaged in carrying out a technology.

Our views are elaborated in considerably greater conceptual detail in the paper in progress. That study also contains some further work on developing more concrete and empirical variables which, we believe, will allow us to test some of the theory- and policy-related assertions which we make about the relationship of technology to organizational development, social change, and the policy making process.

## NOTES ON METHODOLOGY AND APPROACH

John Forester and S. R. Rosenthal

### I

The literature of STOL transport system assessment, already quite considerable, was partially reviewed in our November, 1971, *PROGRESS REPORT*. Those studies, to the neglect of several important concerns, appeared to fall within two major groupings: technical feasibility studies and studies of direct economic impacts. We are convinced that STOL should not be viewed simply in terms of its direct impacts -- the provision of transportation to a limited group of people. Thus we have not investigated any of the design and engineering issues, nor have we attempted to add to the existing array of studies restricted to STOL's potential direct economic impacts. Since November, we have continued to explore the possibilities of conducting more comprehensive assessments of STOL's potential impacts, including its "higher order" effects.

Seeking a more extensive approach to analysis and assessment, we have reviewed additional recent STOL studies, particularly the *Boeing* and the *Rand* Intraurban STOL studies. For this review, we have been more concerned with the implications of their methodologies than we have with their actual findings. We find that like their predecessors they view STOL's impact only in terms of those individuals who are *directly* to use this new mode of transportation and, perhaps, of the resulting "community environmental impacts." This restriction limits the usefulness of these studies because STOL's implementation as suggested by the cases they consider would have other, indirect, effects upon the daily lives of *non-STOL* users. Broad social questions are inadequately addressed. Moreover, even with regard to their more limited objective, direct STOL usage, studies such as Boeing's are quite oversimplified, making rather limited and in some cases naive social and behavioral assumptions about individual and community behavior.

The Boeing report, *STUDY OF AN INTRAURBAN TRAVEL DEMAND MODEL INCORPORATING COMMUTER PREFERENCE VARIABLES* (December, 1971), is technically very detailed.

Beyond that, certain of its procedures require scrutiny. Although it assumes the costs of STOL to be relatively high, the model it uses happens to be quite *insensitive* to cost (p. 134). Such a model is inappropriate for evaluating STOL demand; nor do makeshift or "judgmental" adjustments solve this major inadequacy (p. 149). The demand model consistently *underpredicts* automobile demand (pp. 150, 153); thus *excessive* STOL demand predictions are guaranteed. Nor are the mechanisms for predicting reasonable "demand stimulation" for STOL entirely clear: the model assumes that new demand will arise when STOL is available, but by what means and to what extent remain ambiguous. The analysis of modal split modeling is based on a highly *questionable* use of the preference survey data. Finally, no attempt is made to determine the extent to which unique factors, such as safety, might (in the view of the potential user) further distinguish STOL from other modes of transportation. The study does not adequately consider such possibly negative factors (pp. 60, 61). Admittedly, the limitations found in the Boeing study point to severe problems difficult for any investigator to overcome. But attempts to deal with personal attitudes and preferences within the rigid frameworks of econometric and cost/benefit models will not get very far in overcoming them and can be misleading to the decision maker.

In order to identify more comprehensive methodologies and techniques which could be applied to the analysis of STOL systems, we have begun a more general survey of the state-of-the-art in technology assessment. Our main source in this effort has been the recent work of the MITRE Corporation, in association with the White House Office of Science and Technology. The methodology used in this series of studies (see Bibliography) can be summarized by a sequential series of seven steps which include a definition of the assessment task, key assumptions, potential impact areas, and action options with their associated impacts. We found that the

the MITRE technology assessment studies leave *all* of our crucial general methodological questions unanswered. How, for example, does one attempt to evaluate the *indirect* effects of a particular STOL application on employment, living arrangements, family life, etc.? Any methodological structure for use in answering such questions is lacking in the MITRE approach to technology assessment. We are told what type of building is desired, but we are not shown any skills of construction. Moreover, since so much of the "analysis" in this and other technology assessment efforts is indirect or merely implied, the overall significance of their conclusions is difficult to gauge. We cannot find, for example, any discussion of the political, economic or social value systems which comprise their limiting assumptions.

We have learned that current approaches to assessment are generally inadequate for investigating the full social consequences of implementing a new technology such as STOL. Existing "methodologies" provide the advice that the "systems approach" is desirable. But taking this advice along is not sufficient. A meaningful methodology of technology assessment must explicitly reflect mechanisms underlying the relationship of technology to social change. To date no such methodologies have been developed. Therefore, our current perspectives must be augmented by studies of the nature of social change and the nature of technologically stimulated social consequences. Questions of design and implementation must be treated by improved methods of employing better measurement and simulation techniques and by a clearer focus on empirical questions and data.

During the past academic year considerable effort has been directed to examining several closely interrelated methods which may prove useful in attaining that goal: (1) long range planning and questions of the future, (2) gaming and simulation as heuristic approaches in analysis and inquiry, (3) planning theory as a background for critical analysis of policy planning, and (4) social theory, with particular

emphasis on social change and systems theories. Each of these method areas is reviewed below with some indication of its particular relevance to the general problem of technology assessment. A proposal of what we consider to be the most promising directions for concentration during the remainder of the Project follows that review.

## II

Large scale implementation of V/STOL aircraft is often discussed as applicable to 1985 and beyond. Thus we are concerned with potential consequences of technical development which could occur in ten to twenty years. Planning and analytical problems of *long term time horizons* therefore are added to the myriad problems already involved in any contemporary planning. A long range planning perspective necessarily presents us with the classic problems of prediction and forecasting -- the problems of "futurology" in general. One of the most difficult concerns is the shape of future values: to what degree might conditions in twenty years be sufficiently different from present ones so that what appears to be significant and valuable to us today might then be insignificant or obsolete? Which contemporary values might be expected to change and how?

These questions raise another which is central to long range planning: on what basis are we to evaluate these events and developments whose sources are outside the community or sector being planned and developed? In the case of short-haul aircraft, for example, what consequences are likely to occur regarding the desirable use of this technology if newly developed communications systems or "guaranteed annual income" schemes coexist with this transport system? Should the transport system be integrated with other major or supporting systems in particular ways? This issue of parallel developments necessitates a more holistic approach to the assessment problem than is afforded by the usual incremental one. Attention

must be paid to changes in the social context of a new technology as well as to changes specific to the technology.

The analysis of both value change and of parallel developments raises problems of measurement: How are we to know if and when these phenomena will occur? Where in the social system might they occur, and how can we predict that occurrence? The adequacy of our indicators of social change becomes a matter of first importance in the face of these questions. The problem cannot be solved by using present indicators and then making extrapolations to future conditions: such extrapolation is likely to be as hazardous as any simple extrapolation is by definition. Rather, *dynamic indicators of change* are necessary in combination with more static descriptive ones. Most promising here is the investigation of parallel developments and converging events: What major innovations in various sectors of society may be available at the time a new transport technology could be implemented? For example, what relevant *transport* advances may be newly arrived in 1985?\*

Even if the assessor is able to gather bits of information concerning the questions noted above, he must still make sense of them. How are diverse innovations related to each other now or will they be fifteen years hence? How are they related to aspects of social, political, or economic life? If implemented, V/STOL aircraft is certain to be introduced into a complex web of social fabric; how are we to understand this complexity?

A structural basis for dealing with the basic problems of representing or modeling the future which confront those engaged in technology assessment may be provided by *gaming and simulation techniques*. Gaming simulation requires answers to these requisite questions: *Who shall be represented? Under what rules, and with what medium of exchange within the game?* As a learning tool for participant and analyst alike, gaming simulation in technology assessment promises to have some,

albeit limited, utility. Indeed, the process of game design may be for the analyst a fruitful device for organizing research questions and for critical problem definition. (Where, for example, do we expect there to be significant higher order consequences of introducing V/STOL capability into a moderately developed country?) Game designs also raises for the social scientist a host of interesting questions which serve as generators of "surprises" relating to the fundamental problems of representation: What aspects of the social world are particularly significant? What are their important relationships? Gaming simulation can hardly be looked to as a means for developing predictive powers, but its use as a methodological and analytical tool for problem definition, specification, and ordering seems to be promising.\*

We have also explored another approach which may give substance to our assessment attempts: the use of *social theory*. The approaches we have mentioned above require representations of present and future social reality -- some *models of our social world*. Each analyst brings to a policy or assessment problem a host of notions about society; he comes to it, that is, with an implicit *social theory* in his mind. Such models or theories are implicitly present in his analyses and are drawn upon eclectically as they seem to be useful. We are exploring ways in which deliberate explication of such social theories might be used. It is possible, for instance, that different social perspectives might provide the assessor with a variety of questions to bring to the empirical analysis of V/STOL impacts. How might a systematic explication of these underlying notions provide us with a richer choice of models and paradigms of approach to problems of social impacts and social change -- to, specifically, STOL policy problems? The challenge here is to use social theory to generate empirical research questions for evaluation. We have begun to concentrate study upon theories of social change; perhaps they can tell us about

the dynamics of the generation of higher order social consequences of technological innovations such as V/STOL aircraft.

Further work is planned for the months ahead in each of the areas noted above, with particular emphasis on the development of a methodology of technological assessment. The most promising developments appear to be the use of *planning theory* as a basis for responsible criticism and evaluation of present studies and for the development of systematic models drawn from various theoretical formulations about *social change*. Models are needed which can bridge the gap between theory and empirical reality; such models will aid in generating the *empirical research* which must form the substance of any useful assessment of the potential impacts of the V/STOL aircraft system.

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(\*Note: Five papers have been written by John Forester dealing with, respectively, *values and long range planning* (under the direction of Professor C. West Churchman); *planning, ethics, and complexity in governmental decision making*; *the use of gaming simulation in technology assessment methodology* (under the direction of Professor Richard Meier); *refinements in the theory of social change* (under the direction of Professor Neil Smelser); and *social theoretic models and technology assessment methodology*. These papers have been circulated among the STOL Assessment Project group.)

NOTES ON THE MOBILITY-IMPACT OF PHYSICAL TRANSPORT

S. R. Rosenthal

Our November, 1971, *PROGRESS REPORT* stressed the need to view STOL capabilities as broadly and creatively as possible. We recommended that a broader perspective on STOL's implementation be adopted than that employed in many of the earlier assessment studies which had been restricted to STOL's "competitive" uses, in which its development was viewed as competing with existing modes of transportation, generally along the routing that now exists. We suggested that a more ample perspective could emerge from identifying and assessing new innovative applications of this technology. In the past few months we have been thinking of STOL capacity as a highly flexible, generalized short-haul transport capability whose main potential is *as a means for improving the physical mobility of people*. Thus we have begun to ask the question, "To whom are improvements in physical mobility a matter of concern?"

Our approach has been to move towards the development of a framework for assessing the relative impact of a mobility-based technology (STOL) in different socioeconomic and cultural settings. A major aspect of this work will be the assembling of a wide variety of actual case studies of the introduction of transportation innovations. Urban and cultural anthropology are the primary fields in which such case studies have been prepared; these include social, political, and personal impacts as well as those that are primarily economic. In addition to the more obvious direct effects, these studies attempt also to describe the many indirect impacts of improved physical mobility. Typical contemporary cases of which we have become aware include the use of STOL aircraft in Nepal and the introduction of the snowmobile in the Arctic. (Other cases, such as the introduction of the horse into the Blackfoot Indian culture, are historical.)

The social science literature which we have surveyed to date (see Bibliography) has not yielded us any *comprehensive* insights on the phenomenon of mobility. In the first place, very few *book length* case studies of the social impact of technology exist.<sup>1</sup> Of the shorter, non-comprehensive discussions which do, many are based on surveys too broad to be of use to us for creating meaningful conceptual frameworks for the study of mobility: they are neither specific to particular social groups within the USA nor generalizable to other cultures. *Psychology-based* discussions of mobility indicate to us the difficulty of generalizing from psychological analysis: at best, for a single given situation, a few salient observations on the psychological impact of mobility are possible, though even these may be tenuous because they depend on *specific individuals* who are affected at a *particular time* in their lives and under *unique social circumstances*. Although they are highly particularized also, *ethnographic studies* seem to us to be the most useful ones for tracing the many indirect social implications of introducing a new technology. (Ewers, 1955; Bernard, 1972; Spicer, 1952.) The materialist-determinist approach, however, which claims that technology is the prime mover of human cultural history, is an oversimplification that must be avoided.

In spite of those points on which the literature is inadequate to *our* purposes, it has equipped us to develop a research plan with reasonable expectations. We anticipate that our future work on mobility will require the following approach, to be implemented over the next several months:

- (1) *To continue to review specific ethnographic accounts of the impact of improved mobility on personal/social/cultural patterns.*  
We have begun to identify a collection of such studies, largely in the field of urban anthropology.

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1. Fred Cottrell, *Energy and Society* (1970) is a rare exception but still not particularly useful to us. Not only does it *not* deal with mobility as such, but it does not even provide a broad enough social/cultural framework to help us significantly in our search for a cognitive structure for broadly studying the subject.

- (2) *Develop a cognitive map of these ethnographies, using variables and categories synthesized from our review of the literature on technology and society.*
- (3) *Drawing upon the cognitive map, to speculate on key factors in the different ethnographic situations which were mainly responsible for the various shifts in social patterns after a mobility-based technology had been introduced. (How, in other words, can we begin to explain cross-cultural contrasts in the response to improved mobility?)*
- (4) *Summarize our analysis in terms of its place in the broad assessment of mobility-based technologies*

We envision this current phase of the UC/STOL Research Project as one leading to a useful way of thinking about STOL potential in the broadest sense. Starting with an appreciation of situations where increased mobility "makes a difference," we expect to discover examples where STOL could be uniquely suitable for providing the needed mobility. The range of possible applications for which, in this manner, we will be able to establish motivation is much greater than that considered in the STOL literature to date. Following the approach outlined above, we will, for example, seek unique situations in which *the current level of economic and social development is being restricted by a lack of short-haul transport capability*. A potential capacity also of a technology such as STOL is *the rapid movement of ideas across physical and cultural barriers*; we will also explore possible applications along these lines. The ideal product of this phase of our research would be our identification, enabled by suitable historical analyses, of *high potential STOL applications*.

## NOTES ON PUBLIC ATTITUDES TOWARD TECHNOLOGY

Todd La Porte and Daniel Metlay

As part of the background for anticipating the public reaction to the introduction of a new or improved technology, a knowledge of existing attitudes toward technology is necessary. Our group will be receiving data on a range of such attitudes from Field Research Corporation in early August. A summary of the questionnaire used by this organization for collecting this data follows on page 16.

The interviews taken by the Field Corporation will elicit information on the following subjects:

(1) *Popular conceptions of important changes in the world since about the time of World War II.*

(2) *Attitudes toward twelve specific technologies and their immediate capacities: likely harmful and beneficial results and the degree to which respondents would support or oppose such technologies. (Technologies are grouped according to the six types listed below; specific NASA related technologies are indicated in parentheses.)*

*Transport (SST/STOL)*

*Energy (Satellite related)*

*Communication/information*

*Medical*

*National Defense*

*National Prestige (Space travel)*

(3) *Attitudes toward who or what institutions are and should be involved in national decisions about these six types of technologies, three of which are NASA related.*

(4) *The relative importance people attach to various criteria for decision making about technological development.*

(5) *Various actions people would take if they were opposed to the development of a technology.*

6. *The degree to which people feel that science and/or technology should be controlled.\**
7. *The degree to which people feel uncomfortably dependent upon technologies.\**
8. *The regular range of socioeconomic and political information generally collected in surveys such as this present one.*

Data from this survey will be analyzed and used to test certain hypotheses about the relationship between attitudes toward technologies and likely political reactions to them.

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\*Study of these areas of opinion (6 and 7) is being funded by the International Technology Assessment Project, Institute of International Studies, University of California.

SUMMARY OF PUBLIC OPINION SURVEY:  
PUBLIC ATTITUDES TOWARD TECHNOLOGY

- 1a. First of all, how long have you lived in this state, altogether?  
1b. How long have you lived in this city or town?

| Length of time in--          |                  |
|------------------------------|------------------|
| 1a                           | 1b               |
| <u>State</u>                 | <u>City/Town</u> |
| LESS THAN ONE YEAR . . . . . | . . . . .        |
| 1-2.9 YEARS. . . . .         | . . . . .        |
| 3-4.9 YEARS. . . . .         | . . . . .        |
| 5-9.9 YEARS. . . . .         | . . . . .        |
| 10 YEARS OR LONGER . . . . . | . . . . .        |

- 2a. Now, I'd like to talk about how much things are changing in the world today, things that affect how people make their livings, how life styles are changing, and things like that. I'd like you to think for a minute about changes that have taken place in the lives of the people of this country since the 1940's--say the period since the end of World War II up to the present day. About how much do you think things have changed for the average person? Quite a bit or not very much?

QUITE A BIT . . . . . 1  
NOT VERY MUCH . . . . . 2  
DON'T KNOW. . . . . 3

- 2b. In your opinion, what are some of the things that you believe have changed the most in the life of the average citizen of this country--things such as social and political movements, our way of life, science and technology, or developments in business and industry? (PROBE: TRY TO GET THE RESPONDENT TO MENTION AT LEAST TWO CHANGES)

CHANGE \_\_\_\_\_  
\_\_\_\_\_

CHANGE \_\_\_\_\_  
\_\_\_\_\_

3. For each of the changes listed below, the respondent is to answer how much of a change for the better or worse it has made in life in general, using the following scale:

|              |              |              |              |               |               |               |
|--------------|--------------|--------------|--------------|---------------|---------------|---------------|
| Very         | Quite        |              |              |               | Quite         | Very          |
| much         | a bit        | Slightly     | In be-       | Slightly      | a bit         | much          |
| <u>worse</u> | <u>worse</u> | <u>worse</u> | <u>tween</u> | <u>better</u> | <u>better</u> | <u>better</u> |

- a. The development of household appliances like washers, dryers, dish-washing machines.  
b. The development of automotive vehicles like cars, buses, trucks, etc.  
c. The development of factories that produce things by automation.

3. (cont'd.)

- d. The development of very powerful weapons like the atomic bomb.
- e. The growth in the civil rights movement in this country.
- f. The development of the space program, sending men to the moon, sending space probes to other planets, etc.
- g. The ability to understand and predict human motivations and behavior.
- h. The change in the moral attitudes of people in this country.

4. For each of the technological concepts noted on List No. 1, the following questions will be asked:

- a. Suppose that a development like the one described were to be put into operation. If it were to come into being would it change your own life; very much, quite a bit, slightly, not very much, or not at all?

Change; very much . . . . . 1  
quite a bit . . . . . 2  
slightly. . . . . 3  
not very much . . . . . 4  
not at all. . . . . 5  
don't know. . . . . 0

- b. Regardless of the possible effects on your own life, do you think it would change life for the average person very much, quite a bit, slightly, not very much, or not at all?

Change; very much . . . . . 1  
quite a bit . . . . . 2  
slightly. . . . . 3  
not very much . . . . . 4  
not at all. . . . . 5  
don't know. . . . . 0

- c. How sure do you feel that this development would have beneficial results? Are you absolutely sure, quite sure, or not too sure?

Absolutely sure . . . . . 1  
Quite sure. . . . . 2  
Not too sure. . . . . 3  
Don't know. . . . . 4  
None. . . . . 5

- d. What do you see as the most important benefits, or good things, that might result if such a development were actually to take place?  
(PROBE: ANY OTHERS?)

- e. How sure do you feel that this development would have drawbacks or bad results? Are you absolutely sure, quite sure, or not too sure?

Absolutely sure . . . . . 1  
Quite sure. . . . . 2  
Not too sure. . . . . 3  
Don't know. . . . . 4  
None. . . . . 5

4. (cont'd.)

- f. What do you see as the most important drawbacks or bad things that might result if such a development were actually to take place?  
(PROBE: ANY OTHERS?)
- 

LIST NO. 1

1. High speed trains or monorails covering metropolitan areas to transport large numbers of people quickly from one part of the area to another.
2. Altering people's inherited genes to change certain of their characteristics which they will pass on to their children so that the mental and physical capabilities of future generations can be improved.
3. Space ships which can take people to other planets in the Solar System, such as Mars or Venus.
4. Large passenger airplanes travelling at very high speeds (several times the speed of sound) to transport people across the country or to other parts of the world in a few hours.
5. Power produced from satellites orbiting the earth which collect energy from the Sun and send it back to Earth where it is converted into electrical power.
6. Surgical procedures to transplant different body organs from one human being to another so that people's diseased or injured organs could be replaced.
7. An expanded number of television channels carried into the home by cable so that in addition to regular TV shows from networks, more programs for special interest groups could be made available.
8. Passenger airplanes that travel at high speeds and which can also land and take-off in very short spaces so that they can transport people closer to the places they want to go.
9. Power plants that use atomic energy to produce electricity.
10. Altering brain responses with special drugs so that the behavior of people who have mental disorders can be improved or controlled.
11. Storing large masses of information about the characteristics and behavior of the public on computers so that government and business administrators can quickly get up-to-date, factual information on which to base their decisions.
12. Missiles which can intercept and destroy enemy rockets launched against this country before they get near enough to cause serious damage.

5. Now, I'd like you to take all of these cards (HAND RESPONDENT 6 CONCEPT CARDS) and tell me whether they are things you would like to see, or whether they are things you would be opposed to.

5a. FOR EACH ONE THE RESPONDENT WOULD LIKE TO SEE, ASK: How strongly do you favor this one--very strongly, somewhat strongly, or just slightly? (CIRCLE RESPONSE BELOW. BE SURE YOU'RE ON THE CORRECT LINE.)

5b. FOR EACH "OPPOSED TO" ASK: How strongly do you oppose this one--very strongly, somewhat strongly, or just slightly? (CIRCLE RESPONSE BELOW)

| Card No. | OPPOSED TO    |                   |          | Neither like to see nor opposed to | LIKE TO SEE |                   |               |
|----------|---------------|-------------------|----------|------------------------------------|-------------|-------------------|---------------|
|          | Very Strongly | Somewhat Strongly | Slightly |                                    | Slightly    | Somewhat Strongly | Very Strongly |
| 3        | 1             | 2                 | 3        | 4                                  | 5           | 6                 | 7             |
| 4        | 1             | 2                 | 3        | 4                                  | 5           | 6                 | 7             |
| 5        | 1             | 2                 | 3        | 4                                  | 5           | 6                 | 7             |
| 6        | 1             | 2                 | 3        | 4                                  | 5           | 6                 | 7             |
| 7        | 1             | 2                 | 3        | 4                                  | 5           | 6                 | 7             |
| 12       | 1             | 2                 | 3        | 4                                  | 5           | 6                 | 7             |

6. For each of the technological concepts noted on List No. 2, the following questions will be asked:

a. Which one or two of the people or groups on that list do you think actually has the most say about how things like that are used or dealt with? (RECORD BELOW UNDER PROPER TECHNOLOGY)

b. Which one or two has the least say?

c. In order to represent the public interest, which one or two of the people or groups on that list do you feel should have the most say about how things like that are used or dealt with?

d. In order to represent the public interest, which one or two should have the least say?

(INTERVIEWER: REPEAT FOR EACH TECHNOLOGY CARD: BE SURE TO RECORD THE ANSWERS UNDER THE PROPER TECHNOLOGY NUMBER.)

|  | Technical Experts | Business Leaders | Top Govt. Leaders | Congress-men | The Courts | Organized Consumer Groups | Individual People/ the Public | No One | Don't Know |
|--|-------------------|------------------|-------------------|--------------|------------|---------------------------|-------------------------------|--------|------------|
|--|-------------------|------------------|-------------------|--------------|------------|---------------------------|-------------------------------|--------|------------|

Technology 1.

|                      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|----------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A. Has Most          | . | 1 | . | 2 | . | 3 | . | 4 | . | 5 | . | 6 | . | 7 | . | 0 | . | Y |
| B. Has Least         | . | 1 | . | 2 | . | 3 | . | 4 | . | 5 | . | 6 | . | 7 | . | 0 | . | Y |
| C. Should Have Most  | . | 1 | . | 2 | . | 3 | . | 4 | . | 5 | . | 6 | . | 7 | . | 0 | . | Y |
| D. Should Have Least | . | 1 | . | 2 | . | 3 | . | 4 | . | 5 | . | 6 | . | 7 | . | 0 | . | Y |

LIST NO. 2

1. Our demands for power such as electricity are growing so fast that we may not be able to produce as much of it as we may want. In terms of deciding how this limited power is to be used . . .
2. Too great a use of automobiles may cause congestion in the cities and increase pollution. In terms of deciding how a public system of mass rapid transit which would reduce problems caused by cars would be put into use . . .
3. Medical science has given us the ability to predict the sex, some of the physical characteristics, and to alter the genes of infants before their birth. In terms of deciding if such information is to be put to use . . .
4. Space stations manned by military personnel who can aim rockets and missiles at targets on earth can be designed. In deciding whether they should be built . . .
5. Large amounts of information about the characteristics of the public can be collected, stored and analyzed by computers. In deciding how this information should be used . . .
6. Rockets to take astronauts and scientists to other planets such as Mars can be designed. In deciding whether we should build these space ships . . .

7a. People have different ideas of what should or should not be important in deciding whether technologies such as the inventions which we've been talking about should or should not be developed. In general, when you are deciding whether a given technology is a good thing or a bad thing, which of the phrases on this card best describes how much importance you give to such factors as . . . (HAND CARD D) (READ LIST AND RECORD BELOW)

(INTERVIEWER: HAND PINK FACTOR CARD TO RESPONDENT AND SAY):

7b. Often it is impossible to give equal importance to all of the factors. Could you please arrange these cards in order placing the most important factor first and the next most important second and so on down to the least important which would be seventh.

|   | Ques. 7a                             |                                     |                                     |                                       |                             | Ques. 7b                            |
|---|--------------------------------------|-------------------------------------|-------------------------------------|---------------------------------------|-----------------------------|-------------------------------------|
|   | <u>Extremely</u><br><u>Important</u> | <u>Somewhat</u><br><u>Important</u> | <u>Slightly</u><br><u>Important</u> | <u>Not at all</u><br><u>Important</u> | <u>Don't</u><br><u>Know</u> | <u>Rank in</u><br><u>Importance</u> |
| a. What it may do to make life better and more enjoyable for the average person . . . . .     | 1. . . . .                           | 2. . . . .                          | 3. . . . .                          | 4. . . . .                            | 0                           | _____                               |
| b. What it may do to increase or decrease employment. . . . .                                 | 1. . . . .                           | 2. . . . .                          | 3. . . . .                          | 4. . . . .                            | 0                           | _____                               |
| c. What it may do to increase or decrease taxes . . . . .                                     | 1. . . . .                           | 2. . . . .                          | 3. . . . .                          | 4. . . . .                            | 0                           | _____                               |
| d. What it may do to help or hurt the good image the United States has in the world . . . . . | 1. . . . .                           | 2. . . . .                          | 3. . . . .                          | 4. . . . .                            | 0                           | _____                               |
| e. What it may do to increase or decrease pollution . . . . .                                 | 1. . . . .                           | 2. . . . .                          | 3. . . . .                          | 4. . . . .                            | 0                           | _____                               |
| f. What it may do to help or hurt poor people . . . . .                                       | 1. . . . .                           | 2. . . . .                          | 3. . . . .                          | 4. . . . .                            | 0                           | _____                               |
| g. What it may do to increase or decrease the amount of free time people have. . . . .        | 1. . . . .                           | 2. . . . .                          | 3. . . . .                          | 4. . . . .                            | 0                           | _____                               |

8. (HAND RESPONDENT CARD E) Suppose you felt strongly about some particular technological development like those we have been discussing. Which of the actions described on this card do you think you would be likely to take? (PROBE: ANY OTHERS?)

- a. Attend a meeting or lecture . . . . . 1
- b. Become active in a club or organization involved  
in the issue . . . . . 2
- c. Support your position in discussions. . . . . 3
- d. Attend a protest meeting. . . . . 4
- e. Put a bumper sticker on your car. . . . . 5
- f. Contribute money to support your point of view. . . . 6
- g. Write to congressman or legislator. . . . . 7
- h. Circulate petitions about it. . . . . 8
- i. Vote for a candidate because of it. . . . . 9
- j. Actively work against a candidate who supported  
the opposite side on an issue concerning the  
technology. . . . . 0
- k. Make a special effort to watch TV or read up on it. . X
- l. Other (specify) \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
- m. None of these . . . . . Y

9. For each of the statements listed below, the respondent is to answer using the following scale:

|                                 |                                 |   |                                    |                                    |                             |
|---------------------------------|---------------------------------|---|------------------------------------|------------------------------------|-----------------------------|
| <u>Strongly</u><br><u>Agree</u> | <u>Somewhat</u><br><u>Agree</u> | <u>Neither Agree</u><br><u>Nor Disagree</u> | <u>Somewhat</u><br><u>Disagree</u> | <u>Strongly</u><br><u>Disagree</u> | <u>Don't</u><br><u>Know</u> |
|---------------------------------|---------------------------------|---|------------------------------------|------------------------------------|-----------------------------|

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- a. Any attempt to control which inventions are widely produced or made available will make our lives worse.
- b. The only way to make sure that what scientists learn will not cause a lot of harm is to stop them from studying things unless they are clearly important and beneficial.
- c. Unless scientists are allowed to study things that don't appear important or beneficial now, a lot of very beneficial things probably won't ever be invented.
- d. Basically all scientific discoveries are good things; it is just how some people use them that causes all the trouble.
- e. If they are given money and let alone, scientists can be counted on to invent things that will make all our lives better.
- f. People shouldn't worry about harmful effects of technology because new inventions will always come along to solve the problems.
- g. Technology has made life too complicated.
- h. We must make certain that scientists are not allowed to study certain things in the first place because they may cause a lot of harm.
- i. No one should attempt to regulate which inventions are produced because it interferes with the individual's right to decide what he wants to buy.
- j. People have become too dependent on machines.
- k. Unless there is some regulation of which inventions are widely produced or made available, our way of life will become worse.
- l. It would be nice if we would stop building so many machines and go back to nature.
- m. The standard of living would decline if there were less technological development.
- n. No one should attempt to regulate which inventions are produced because they do not know how to do it.

Now, just a few more questions for classification purposes:

10. First, in politics today, do you consider yourself a Republican, a Democrat, or as a member of some other party? (If other party) What other party?

|                                   |   |
|-----------------------------------|---|
| Republican . . . . .              | 1 |
| Democrat . . . . .                | 2 |
| Other Party _____                 | 3 |
| (specify)                         |   |
| Declined to state party . . . . . | 0 |
| No answer . . . . .               | Y |

11. Do you consider yourself more as a conservative or more as a liberal? (If Conservative or Liberal, ask): Do you consider yourself to be strongly (conservative) (liberal) or just moderately (conservative)(liberal)?

|                                       |   |
|---------------------------------------|---|
| Strongly Conservative . . . . .       | 1 |
| Moderately Conservative . . . . .     | 2 |
| Neither, Middle of the road . . . . . | 3 |
| Moderately Liberal . . . . .          | 4 |
| Strongly Liberal . . . . .            | 5 |
| Don't know, No opinion . . . . .      | Y |

12. How did you vote on Proposition 9, the environment initiative? INTERVIEWER, GET ONE OR TWO REASONS WHY THE RESPONDENT VOTED AS HE DID ON PROPOSITION 9.

13. ASK FOR CHIEF EARNER IN FAMILY:

14. Are you/is the chief earner employed by someone or is he in business for himself?

15. What kind of work do you/does the chief earner do?

\_\_\_\_\_  
(type of work)

\_\_\_\_\_  
(industry)

16. How much does your (WHEN THE RESPONDENT IS NOT CHIEF EARNER USE CHIEF? EARNER'S) job depend on future advances in technology?

VERY MUCH

SOMEWHAT

NOT VERY MUCH

NOT AT ALL

DON'T KNOW

- 17- (Standard questions concerning education of respondent, age, income, sex, ethnic/racial category, etc.)

## NOTES ON THE REGULATORY PROCEDURES OF TECHNOLOGY: A PRELIMINARY STATEMENT

Ira Kurzban and Dane Miller

Both the enthusiasts and adversaries of technological development recognize that the introduction of technology into our social milieu has prompted consequences far beyond those originally foreseen. Unlike the situation a century ago, when we had relatively simple techniques in more stable and less interdependent social and economic institutions, we are now confronted with increasing interdependence within our social system, increasing complexity of new technologies, and their apparently accelerating and more widespread application. Within the past decade, institutional authorities have begun to realize the necessity of finding strategies for new programs that can adequately account for and perhaps shape these changes. In increasing numbers we awaken, like Rip Van Winkle, to a world whose configuration and principles of operation jolt us with "future shock." We rely on descriptions and methodologies no longer applicable to present circumstances; we have at present neither the knowledge nor the vocabulary necessary for analyzing many of the consequences of technological development. Our inability to understand or forecast these consequences has led to action and policy based on models of our social world which probably do not correspond very well to the complexities of our actual social organization. The particular result of this situation is our inability to regulate technological "progress" effectively.

In an attempt to understand and control technological systems, we simplify our conception of them and are often tempted to act as if they functioned in a readily identifiable manner which accords with that simplification; the result is often ineffective policy and action. This tendency to *oversimplify* technology is frequently reflected in the language used to discuss its regulatory procedures: attempting to create closed, "knowable" systems, we often confuse the language of regulation with

that of *rule making*. The latter is quite applicable to situations where the effects of a particular course of action are predetermined, as in the game of chess: here one is aware of the *rules* before he plays; *a priori* they are present in this closed system of action. In this respect rules establish a high degree of linearity and *create* a closed system prior to its use. Technology *has* no such rules.

#### REGULATORY BACKGROUNDS

For the sake of developing a better understanding of the difficulties involved in controlling technological complexity, we have retraced some of the ground that has led to the development of regulatory procedures in the United States. Prior to the inception of the Interstate Commerce Commission in 1887, formal regulation of technology remained principally within the domain of the market itself. Occasionally, State and Federal lawmakers intervened in the development of various technologies, but such intervention often was to subsidize them, rather than to plan or impose policies. With the establishment of the ICC, the federal government ushered in a new policy, designed to control the railroad technology in the public's interest. Since it was the first agency of its kind established on the federal level, it set a precedent for those that followed. Operating upon a technology and within a social context that were relatively simple (in comparison to those of the present), the ICC was quite successful in performing its designated function of regulating freight and passenger rates.

Ideological Tension: A Free Market and Regulation in the Public Interest. One conflict, common to many regulatory procedures, has arisen over the attempt to constrain industry while yet maintaining the premises of a free market economy. As a result, many policy makers primarily view regulation in negative terms -- as *sanctions against* the regulated companies -- and planning for it as antithetical to the free market system. "Regulation," therefore, has been generally left to the private sector, the

role of the public agency having been mainly one of case-by-case decision making, usually *ex post facto* in response to specific complaints brought to its attention after inequities in a particular system had become apparent. The tension between the ideologies of a free market economy and the control of industry in the public interest has frequently been made manifest by decision makers seeking the aid of the regulated industry. This involvement of industry in its own regulation also ensures that any policy changes will not drastically upset its economic position or have adverse effects on the economy as a whole. The "public interest," then, is perceived largely in terms of the nation's overall economic stability. As the public and private sectors become increasingly interdependent, this emphasis on the whole economy is likely to be reinforced.

Vested Interests. Close ties with the private sector are fostered also by the nature of political influence upon regulatory agencies. Because public interest groups are represented only occasionally and on an *ad hoc* basis, the interested industries do most of the political lobbying on public issues, a practice which results in highly partial presentations of information before commissioners. The more general public interests, such as that represented by conservation groups, lack the means of presenting their petitions in the polished, professional manner common to the lobbying staffs of regulated industries. Thus these appeals often appear vague and inarticulate to the regulative agencies to whom they are addressed. This disparity in access to political influence and in the quality of influence often encourages agencies to develop perspectives in close correspondence to those of the industries they are entrusted to regulate. The problem of inequitable representation before regulatory commissions is compounded by biased sources of expertise for decision making: often, regulatory bodies seeking information concerning a particular technology are forced to rely on members of the regulated company. This imbalance is further aggravated

by the frequent turnover in agency personnel to and from the private sector. As with other aspects of the policy making process, the predominance of industry as the frequent source of expertise contributes to the often documented *dependence* of regulatory agencies *upon* industry.

Changed Conditions Among Technologies. Perhaps the most important recent factor contributing to the regulatory dilemma has been the development and implementation of various interdependent technologies. For example, the interrelationships between rail, air, sea and land transportation in addition to a variety of communications technologies have created a complex web of non-linear relationships unforeseen at the time of the establishment of the first regulatory agency. The governmental response to this situation has unfortunately been a replication of its handling of the ICC. Instead of creating a system of regulatory procedure which could account for the *interdependencies* of technologies within the whole transportation/communications complex, it created only agencies corresponding to *specific* technologies. The result has been at least thirty different bureaus, departments, and agencies concerned with diverse aspects of transportation and communications policy. And even if the *coordination* of these separate bodies were seriously considered desirable, this task would be enormous. At the present time, however, no such coordination is actively pursued. Most agencies operate within a structure and according to a methodology which assumes that the problems of *their* technology are independent of and unrelated to the array of other existing technologies. Thus, to use the Civil Aeronautics Board as an example, while it maintains regulatory power over *routing* of air transportation, it has only limited authority with respect to all the other phases of air technology (sharing it with the Federal Aviation Administration, the National Aeronautics and Space Administration, and the Department of Defense) and *no* authority over highway, waterway and rail transportation technologies. >

Changed Conditions in Society. The early success of the first agency to regulate a technology was due in part to the prevailing simplistic notion of *what* it was to regulate and in part to the simplicity of the social milieu in which it operated -- the relative paucity of *connections* between various segments of the society. Ensuing decades, however, have brought an increasingly complex society with many more and powerful *interconnections*. This increased complexity forces an expanded perception of areas requiring regulation. As they stand, regulatory agencies are neither empowered nor able to remedy the problems that have accompanied these social changes.

#### PERSPECTIVES OLD AND NEW

Having spent a number of months researching the relationships between present technologies and regulatory procedures, we see clearly that existing processes are inadequate to meet the contingencies of technological growth. This is clearly the case for regulatory mechanisms which would be most applicable to STOL aircraft implementation. In order to move beyond current thinking about technical regulation, we have found it necessary to begin by unraveling the complex relationship between a technology and any process of regulation applied to it. We have begun by sub-categorizing areas within each of the two concepts, *TECHNOLOGY* and *REGULATION*.

With regard to *TECHNOLOGY*, three different perspectives may be taken, each prompting a different means of regulation. Technology can be thought of (1) as theoretical knowledge that allows one to alter the environment, (2) as the mechanical or corporeal form of the technique as it appears once it is conceived, and (3) as the cooperative systems of people working together to implement these theories and conceptions and make technology manifest. The following outline demonstrates how elements related to the first of these perspectives might be categorized:

## *TECHNOLOGY AS AN IDEA*

### Internal Aspects of the Idea

1. Scope (wide or narrow? heuristic abilities? capacities for future additions?)
2. Consistency (given a particular logical system)
3. Applicability (immediate or unlikely? expectation of return?)
4. Cost associated with development of the idea

### Environmental Aspect Most Closely Affecting the Technology as Idea

1. *Zeitgeist* (common feelings toward technology due to habits, customs, taboos, religious dictates, role perception, etc.)
2. Intellectual (as opposed to societal) constraints (e.g., linguistic inability to speak of or conceptualize certain matters: holes in the conceptual schema used by the individual or by society.)
3. Stability of both the intellectual and societal areas and their impacts on a particular "technology as idea."

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If technology is viewed only in this sense, as theoretical knowledge and potential technical capacity (as it often is by scientists), it lends itself to regulation only in a very rough and limited way. Cultural norms, taboos, and linguistic constraints are some of the ways in which theoretical concepts have been "regulated" in the past. When discussing regulatory processes, the literature adopting this perspective usually focuses on primitive societies but suggests that there is at least a residual element of this type of restriction in "rational" societies like our own. Such "regulation" is essentially psychological and operates on aspects of the technologist's thinking other than the theoretical ones. It is, moreover, extremely difficult to employ and probably not amenable to legal process such as practiced in the United States.

The second perspective, that which views technology as the mechanical or corporeal form of the developed technique, is anatomized in the outline which follows:

*TECHNOLOGY AS A MECHANICAL/CORPOREAL TECHNIQUE*

1. Production
    - A. expenses involved
    - B. complexity/sophistication of processes (mechanical, not organizational) needed to implement the technology
  2. Relative degree of centralization or dispersion of needed processes
  3. Variable production times
  4. Physical limitations inherent in the technique itself
- 

This perspective is limited to the *physical* technology: the machine, tool, or implement as defined by its capacity to perform a particular function or set of functions. In this respect, we do not think of technology as having a particular teleology, that is, as being *purposive*: its capacity for various functions is, rather, limited by the range of perceived uses for its particular *physical* structure. Regulatory procedures have been inextricably bound to this perspective of technology. Accordingly, we have looked at a particular technology solely as a machine, distinguishable only by *how we should curb its capacity after it has been put into use*. Thus, considerations as to the prior design of the technology hinging on its interdependence with social organization have been subordinated. Past regulatory procedures related to this limited perspective of technology are prominent in the field of transportation. Regulation of the train, the automobile, and the airplane has on the whole been perceived as the placing of constraints upon the *operating physical machine*.

A good part of our time recently has been taken up with exploring the ramifications of the *third* perspective on technology, that which focuses on the *organizations* needed to implement various theoretical constructs. These organizations may be categorized according to their individual characteristics and then matched against various regulative procedures now practiced by our government. In doing so, we

have considered in our scheme both the internal characteristics of a technology-implementing organization and the system of relationships this organization has with other organizations and individuals on the outside. We hope to develop a basis for arguing that a STOL system can be designed to be efficiently *run*, in a particular social milieu, as well as effectively *regulated*, if its organizational structure and policies have certain characteristics.

Our thinking within this third perspective is outlined below:

#### *TECHNOLOGY AS A COOPERATIVE SOCIAL SYSTEM*

1. Structural Characteristics of a Certain Organization
  - A. hierarchical vs. field organization (vertical vs. horizontal integration)
  - B. serially linked, mediating or complex organization
  - C. size of organization
  - D. variable power of various parts of the organization; what is the core area? the organization most dependent on research, production, or marketing for its continuance?
2. Functional Characteristics of a Particular Organization
  - A. degree of psychological integration of individual within the organization? i.e., role congruence, loyalty, cohesion, etc.
  - B. internal communication and social integration
  - C. productivity: output of material, decisions, etc.
3. Relations with the External Environment
  - A. access to necessary resources: capital, skilled, labor, raw materials, energy, etc.
  - B. degree of interdependence with other organizations
    - (1) input -- organization is dependent on some other organization for land, capital, labor, information, etc.
    - (2) output -- population served, services rendered; organization dependent on some other to take its product?
    - (3) relations with various regulatory agencies, interconnections?

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In conjunction with the first two perspectives, this one enables us to gain some insight into the various ways in which we might describe an array of technologies. We have arrived at the following set of variables or parameters for describing the

*INSTITUTIONAL FORMS OF REGULATION:*

1. Number of agencies, commissions, departments concerned with a given technology.
2. Degree of interaction with other agencies
3. Degree of responsibility
4. Degree of control
5. Number of people who work for agency
  - A. Number of commissioners
  - B. Number of examiners
6. Structure of information (classified and non-classified)
7. Structure of command (hierarchical, autonomous, multilateral)
8. Executive control
9. Congressional control
10. Influence of companies who use technology
11. Influence of groups using technologies (unions, organizations)
12. Influence of companies who manufacture technology
13. Influence of public interest groups
14. Influence of the courts (number of cases)
15. Work of agency (through rules or casework)
16. Tension between function as regulator and planner
17. Intensity of regulations issued (restrictive, moderate)
18. Degree that agency functions as planner
19. Degree that agency functions as innovator for new ideas
20. Ability to reverse/alter technological development
21. Stability of agency
22. User supported/public supported agency

But regulation may also be thought of as functioning in a manner different from what is implied by these institutional forms. As in the case of bodily homeostasis and cybernetic systems, regulation occurs *within* the process itself. Unlike rule making, it is not established prior to organization of the system but assumes non-linear relationships which are directed toward maintaining internal balance. These distinctions are of paramount importance for understanding regulation in any analysis of technological systems; they emphasize the maintenance of internal balance in

regulating within a social system. Accordingly, all parts of the social system become mechanisms for regulating technology. Because technological complexity in a social system is open, highly interactive, and multidimensional, regulation as the process of *mutual adjustment* becomes *self-regulation*.

Pre-institutional Elements in Regulation. In the following, we suggest a number of variables which regulate technological systems in that manner:

#### Ecological Regulation

1. Pestilence
2. Disease
3. Population
4. Climate
5. Disaster

#### Economic Regulation

1. Free market  
(user supported)
2. Government control  
(public supported)

#### Political Regulation

1. Persuasion
2. Coercion (war)
3. Mediation
4. Authority (as distinguished from power)
5. Mutual expectation
6. Public opinion
7. Legal tradition

#### Appreciative System

1. Paradigm
2. Language
3. Historical perception
4. Psychological perception
  - A. Need
  - B. Desire
5. Knowledge
  - A. Feedforward
  - B. Feedback
  - C. Information flow
6. Role perception
7. Habit
8. Custom
9. Religion (totems, sacredness)

#### Systemic Institutional Structures

1. Hierarchical - Dispersed
2. Structural - Functional
3. Centralized - Decentralized
4. Micro - Macro
5. Physical proximity

We intend these variables to be seen as part of a possible way of viewing regulation within non-linear social systems where there is only limited knowledge available about the social impacts of technology. In the next few months we will use these variables as a basis for analyzing the possibility of new institutional arrangements for regulatory procedures; particular emphasis will be placed on those

that could be employed for STOL. It is clear at this time that any regulation of STOL aircraft must consider STOL's relationship to all other transportation/communications technologies. We may also, in this regard, pursue the question of whether STOL, because of its particular technological characteristics, might be amenable to relatively *decentralized* regulatory procedures. Another useful task may be the refinement of the above variables into a second set which could be incorporated into a matrix to serve as a guide for policy makers concerned with suitable alternative institutional arrangements for the regulation of a given technology.

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(The following entries are intended to supplement the general list of works which appeared in our November, 1971, *PROGRESS REPORT*. Categorized here according to several subject areas comprising this present review of our activities, these references are by no means exhaustive; but along with our earlier bibliography, this one should convey an adequate idea of the scholarly and professional background against which our research is being done.)

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